INSTALLATION OF PREFORMED NEOPRENE

COMPRESSION JOINT SEALS

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The effectiveness of in-service performance of a compression joint seal is dependent to some degree upon proper installation.

Since there are wide differences in pavement design, joint forming and sawing practices, materials and methods of construction, climatic behavior and engineering supervision throughout North America and the free world, as well as fundamental policy differences with regard to legal responsibility for maintenance, it is difficult to generalize regarding what constitutes proper installation. It is acknowledged that there are understandable differences in emphasis on the factors important to extending the maintenance free life of a pavement from state to state, province to province and country to country. If, however, it is possible to prolong the serviceable life of a concrete pavement utilizing compression seals, design engineers should give consideration in their written specifications to the inclusion of certain language that will insure everything is being done to get the most out of these seal configurations in the light of present knowledge. It is the intent of this paper to discuss some of the fundamentals that are important, generally, with relation to proper installation practice in various types of jointing environments on a highway.

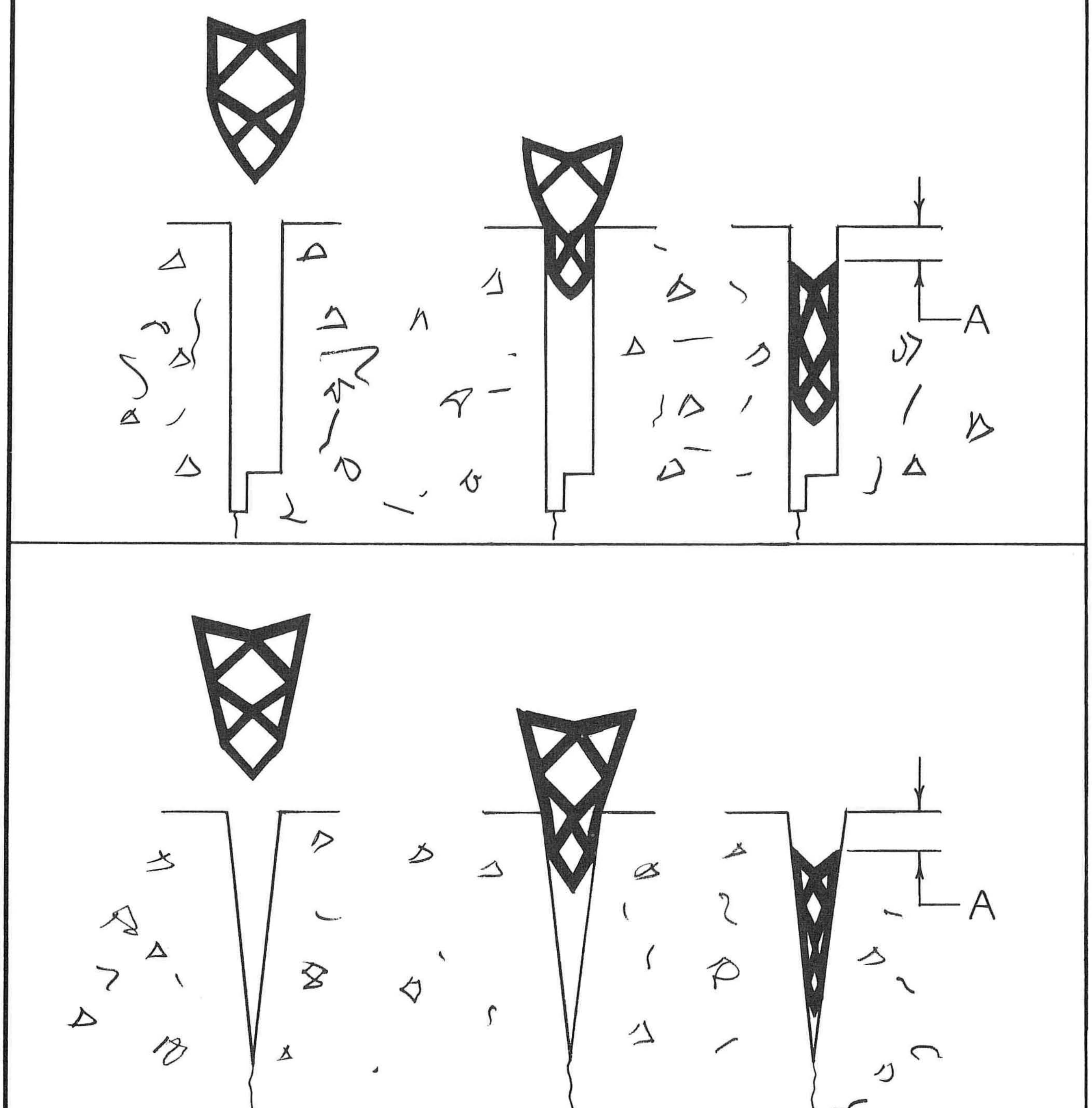
Typical compression seal configurations are, in reality, elastomeric sealing devices, each with a rated movement capability, designed to fit into a definite predetermined shape of joint to accommodate predictable categories and ranges of movements. The pavement design engineer in his written specification must exercise positive control over the factors governing potential variances in seal configuration, web tolerances, maximum and minimum joint openings at the time of installation, stroke of movement between interfaces, characteristics of the lubricant-adhesive, position of the seal in the joint shape, as well as certain time dependent joint geometry changes if he is to achieve near perfect installation, since the contractor's performance is in some respects limited to the very language or by the lack of language in a specification.

SEAL POSITION IN JOINT SHAPE - CONTRACTION JOINTS

Generally, the following principles of positioning in contraction jointing apply: (See Figure 1)

1. The seal configuration should be positioned in the joint shape with its vertical axis reasonably parallel to the joint interfaces.

2. The inner and outer webs of the seal configuration should be juxtaposed in their true congruence rather than being intussuscepted or telescoped with a resultant potential for "popping" as the joints begin to open in contraction.



"A" DIM 1/4" FOR SEAL SIZES UP TO 13/16"

"A" DIM 1/2" FOR SEAL SIZES GREATER THAN 13/16"

FIG. 1 - SEAL POSITION IN JOINT SHAPE
CONTRACTION JOINT

3. The top corners of the seal should be in reasonable contact with the joint interfaces.

4. The top of the seal, at the time of installation preferably, should not be higher than 1/4" below the riding surface of the pavement for contraction joint seals 13/16" (uncompressed width) and smaller. For larger seals, such as 1-1/4" contraction seals (uncompressed width) and down to but not including 13/16" sizes, the top surface should be positioned at approximately 1/2" below the riding surface of the pavement at the time of installation. While this might appear to be somewhat low in the joint, long term experience has shown that typical attrition to the top edges of joints, as well as the inevitable minor edge ravelling from joint sawing, justifies these setting heights as being practical. To obtain their full life, these rubber seals should never under any condition of slab movement, be touched by traffic, studded tires, snow plows, etc., since attrition will take its toll. The top portions can actually sustain wear not unlike the heels of shoes.

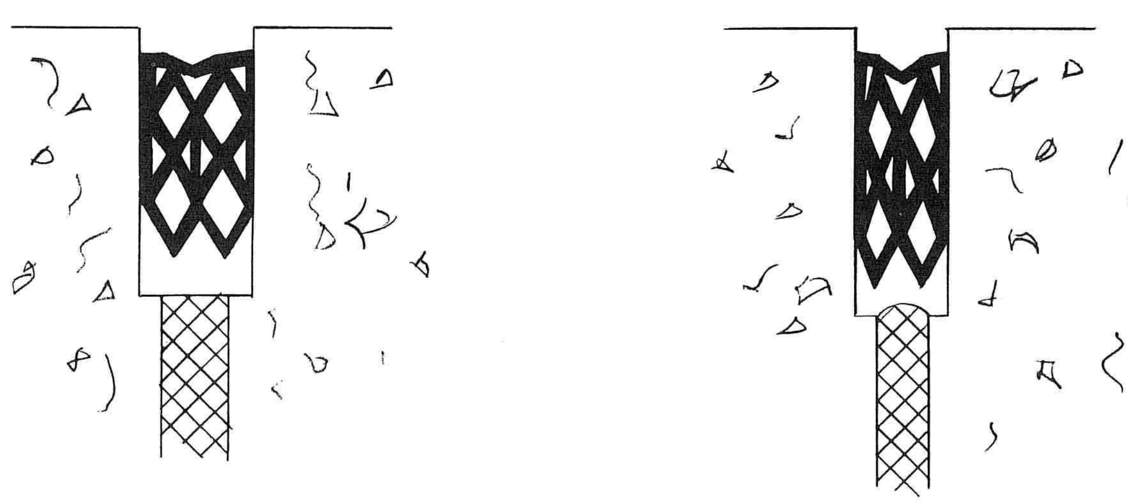
SEAL POSITION IN JOINT SHAPE - EXPANSION JOINTS

Pavement expansion joints are normally wider, usually anywhere from 3/4" to 1-1/2" width, and since they exist to relieve compressive stress, they require different construction practices to reflect movement phenomena peculiar to their specific application. When used in a line of contraction joints or as bridge approach joints, expansion joints, in addition to reflecting normal thermal volume change, can and usually do, progressively close. A multiplicity of reasons exists for this progressive closure, such as positive creep, the forces of gravity in inclined planes, caterpillar action of slabs from normal volume changes in contraction joint pavement, etc. It is not the purpose of this paper to account for this change in slab positioning from its as-constructed location but change it normally will, and this must be taken into consideration by the pavement design engineer if he is to extract the full measure of service life from his expansion joint seal. Since the forces of progressive closure are of a bursting magnitude, the compression limits of the seal selected must not be exceeded if the expansion joint should progressively close to near zero opening. If its limits in compression are extruded, a compression seal will begin to flow in similarity to a liquid seal. (See Figure 2).

Couple this with some vertical extrusion of the expansion joint filler material down below and the seal can only migrate upwards. The construction practice recommendations shown in Figure 3 are simply obtained in the field and preclude the possibility of seal extrusion. Generally, the same four positioning rules used in contraction jointing will apply to expansion joints as well. Due to the complete absence of control of joint geometry, plus a tendency toward durability loss from the old hand edging process, a recent strong trend is in evidence toward the sawing of expansion joints. Ideal control of expansion joint geometry, including the relief steps in Figure 3, is now being achieved by tandem blade sawing over the joint filler material.

AS CONSTRUCTED

EFFECT OF PROGRESSIVE CLOSURE



RECOMMENDED CONSTRUCTION PRACTICE

FIG 3-SEAL POSITION IN JOINT SHAPE
EXPANSION JOINT

SEAL POSITION IN JOINT SHAPE - LONGITUDINAL JOINTS

Since most longitudinal joints are tied together with a variety of devices, keys, etc., it is logical to assume that a zero movement condition prevails. Based on wide-spread photographic evidence from thousands of miles of concrete pavements now in service throughout the states and provinces of North America and abroad, it is suggested that there may well be a number of categories of movement phenomena that can and actually do occur at longitudinal joints which would permit the entry of free water, solids and chemicals deleterious not only to concrete, but the highly corrodible metals used in tie bars and hook bolts and the hydraulicly vulnerable sub-base as well.

Hinge type movement at the interfaces can be the effect of the heaving and tossing of freeze-thaw tending to jack the slabs apart. (See Figures 4 & 5).

Slight to massive sub soil faulting, natural as well as from insufficient compaction, produces rotation movements at interfaces of joints. Differential truck traffic loadings can literally pound the truck lanes to a lower elevation, particularly when 12' lanes are constructed singly. Thermal differences from top to slab bottom during rapid changes of temperature produce warping stress which, under certain circumstances of slab length, can produce an end curling motion at the juncture of longitudinal and transverse joints which at its apex can be accoustically evident as well as graphically observed by the laying of one's cheek across a joint at the exact moment of the passing of a heavily loaded truck either at high or low speeds.

Historically, concrete pavements have shown their worst evidence of distress in crushing at this juncture, generally approximating two feet in either direction from the transverse joint as is evident in Figure 5. The daily and seasonably recordable longitudinal change in length of 24 inches per mile of jointed concrete pavement for a temperature gap of 80-100 degrees also suggests that there can be movements in this plain which can provide severe localized stress not only on the sealing system but by elongating gaps in the pavement that potentially can operate to shorten a pavement's serviceable life. Recent attempts to reduce the cost of 24 - 36 - 48 foot wide concrete pavements by the mere introduction of crack inducing devices may some day, long ahead in the future, prove to be economically sound in certain arid, non-freeze thaw, slight temperature gap environments. However, the relatively small cost, both in materials and construction, required to produce good longitudinal joints of high permanence would appear to be justified when one considers the tremendous investment in public money now required to build a mile of pavement.

Figure 2. Progressive closure of expansion joint resulting in extrusion of seal.

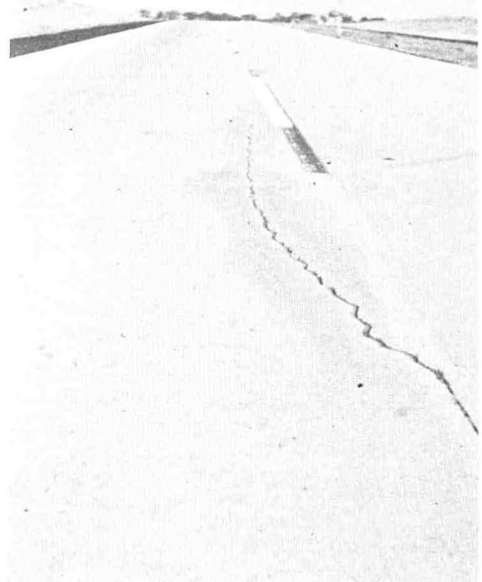


Figure 4. Hinge movement at crack near longitudinal joint tends to jack slabs apart.

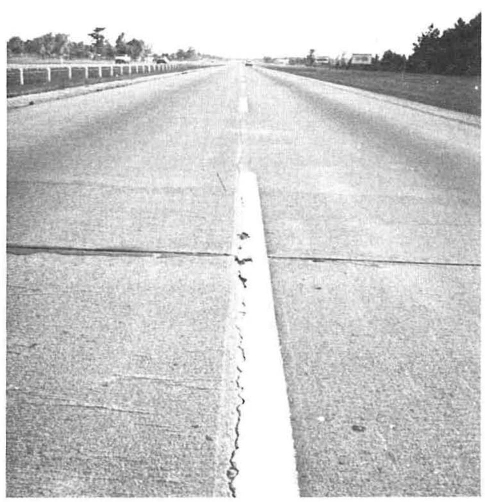


Figure 5. Evidence of hinge and warping movements with distress being more severe at juncture of longitudinal and transverse joints. (Longitudinal joint formed with crack inducer)

The rules for positioning transverse joints similarly apply to longitudinal joints. Since the stroke of movement is not nearly so dynamic as with transverse joints, smaller seals, and in non-freeze thaw areas, narrower joint widths have appeared to offer successful sealing solutions.

Figure 6 illustrates 1/8" saw cuts and small 5/16" seals currently in wide usage on Texas Highway Department longitudinal joints in continuously reinforced pavements. The 1/4" saw cut with a 7/16" seal is used on longitudinal joints in New York, Maryland, Ontario, Quebec, etc., and freeze thaw areas in general.

The juncture of the transverse and longitudinal joint is normally a cut and butt proposition, however, if the transverse seal is substantially larger than the longitudinal seal, the latter may be installed in a notch cut into the transverse seal just deep enough to receive it fully. It is common practice in some states to install the longitudinal seal first, followed by cutting it to receive the transverse seal when it is installed. (See Figures 7 & 8).

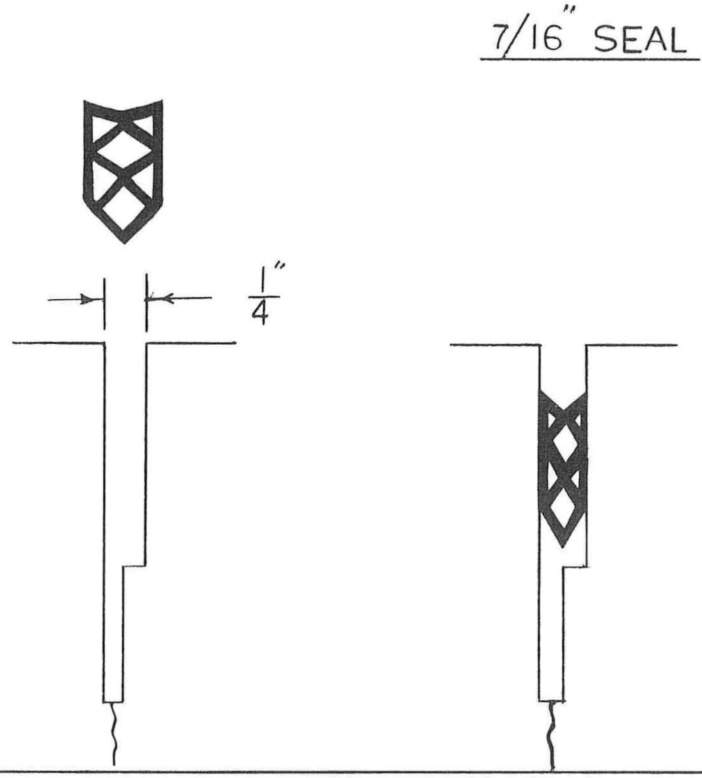
LUBRICANT - ADHESIVE

It would be extremely difficult, if not impossible, to insert a compression seal into most joint openings without lubricating the joint interfaces. In addition to this, a priming agent is required to establish continuity of the seal with the joint interfaces. Further, it would be desirable to bond compression seals in place and so a lubricant that is also an adhesive with an approximate 3 - 5 minute pot life is used. Insufficient as well as excessive lubricity can be troublesome in the installation practice. A sufficient amount of the lubricant-adhesive should be used to negate the forces of frictional refusal as differentiated from mechanical refusal.

Excessive adhesive has been known to accumulate on the top portion of the seal configuration and bond the top corners together preventing their recovery, and since it is hardly possible to keep the tops of seals entirely free of adhesive, this bond should always be broken. In wedge type joints, if an excessive quantity of adhesive has been applied, seals can begin to migrate upwards after installation, before the adhesive sets.

Hot dry weather can produce a condition of premature set to the adhesive and this can be the cause of seal popping.

The installer must be alert to these conditions and make the necessary field adjustments in the adhesive to either trigger or prolong its set as it needs be.



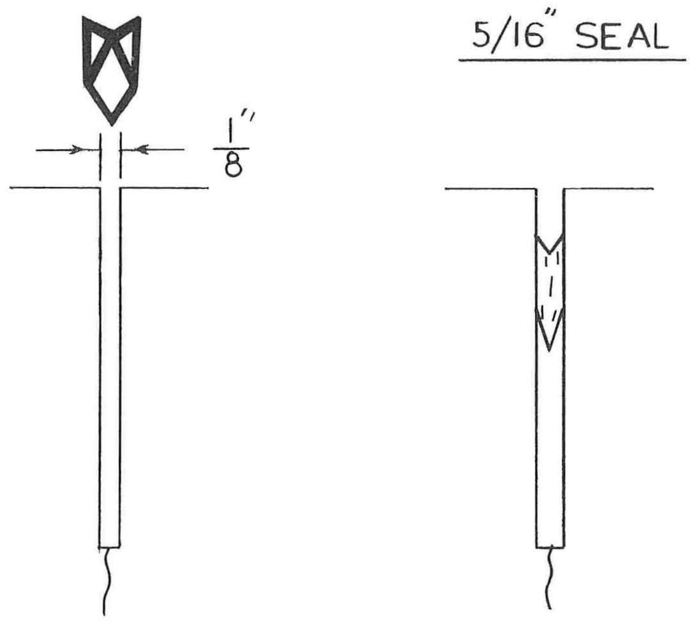


FIG. 6 - SEAL POSITION IN JOINT SHAPE
LONGITUDINAL JOINT

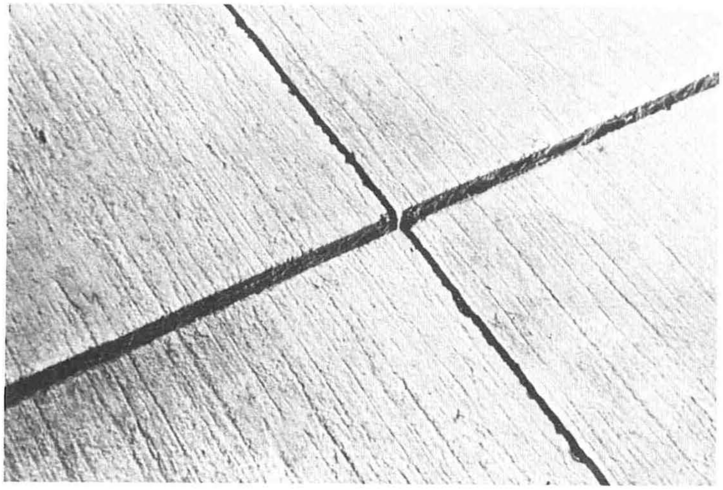


Figure 7.

Unsealed juncture of transverse and longitudinal joints.

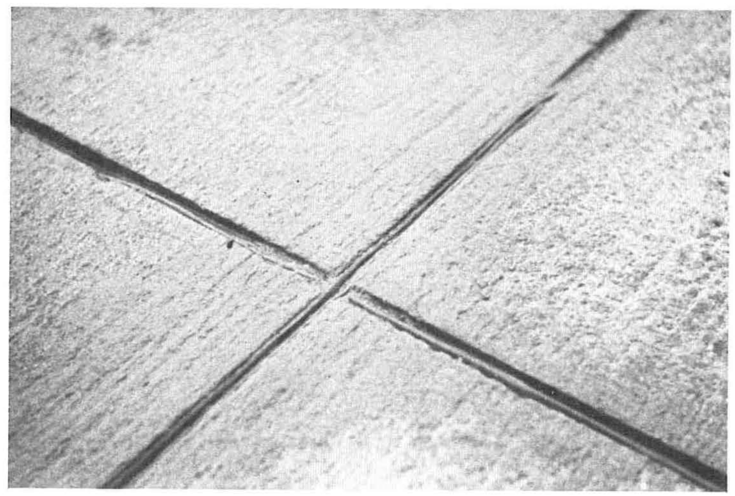


Figure 8. Sealed juncture of transverse and longitudinal joints.

Figure 9. Applying the lubricant adhesive.

Figure 10. Hand roller insertion.

GROWTH - STRETCH

An old bromide in the rubber industry concludes that placing a rubber part in unrelieved tension for prolonged periods of time will shorten its useful life. The natural desire of a compression seal or any rubber part to elongate when compressed coupled with the tendency on the part of installing personnel to physically stretch the seal for ease of insertion has given some cause for concern. Since it is difficult to visualize the true condition of stress imposed upon a rubber molecule in this application, after being elongated and then subsequently compressed in a joint, one can only theorize that there is really a problem for concern. The point in elongation during installation of a seal at which unavoidable compressive growth stops and mechanical stretch begins, is, in the light of present knowledge, unpredictable since there are constant unavoidable variations in the seal web thicknesses within allowable tolerances, constantly changing joint widths, saw blade wear, differential friction on joint interfaces, etc., all of which can require greater or less compressive force for inserting a seal. To simply remove a seal after installation and to compute the percent of elongation without relating the resultant shortage to the above variables may not be a meaningful measurement.

From the practical standpoint, there can be definite evidences of excessive stretch, such as short gaps in the seal a day or so after installation. Apparently, the rubber compounds that seem to give excellent service are somewhat "notch sensitive" and minor cuts or tears in installation can pull apart. The tendency of some compounds towards porosity can also result in tearing apart at these points of stress concentration. This pulling apart in the joint is normally the result of too narrow a joint for the seal configuration, however, seal extrusions that run on the high side of the web tolerances can compound the stretch problem.

Severe elongation or stretch can also serve to reduce the uncompressed width of the seal somewhat.

Realizing that a resulting condition of over-compression could be equally as detrimental as over-elongation, limits of somewhere between 5 to 8 per cent elongation in properly constructed contraction joints appears to be most desirable.

HAND INSTALLATION METHODS

In its development period, compression seals were first installed with blunted screw drivers, followed by hand paint scrapers. Subsequently, a grass edging tool was modified into the present and still widely used hand roller inserter. (See Figures 9 & 10).

Most of the oldest installations of compression seals that are still performing effectively were installed with hand rollers and subsequently, something in the neighborhood of 20 millions of feet have been similarly placed. On small paving projects, they are still a practical tool, and on larger sized pavement seals, a weighted roller is giving excellent performance. Contractors in Michigan, after some three years of compression sealing by machine installation, have tended to return to the hand roller method of insertion.

MACHINE INSTALLATION METHODS

Automatic and semi-automatic methods of machine installation are presently in various stages of development and use both in North America and in Europe. They currently may be categorized in principle as follows:

a. Mechanical Compress-Eject

The seal is compressed by vertical or horizontal discs, roller wheels or rotating bands, and then ejected into the joint opening. Lubricant-adhesive is applied to either the seal, or joint interfaces, or both immediately prior to insertion. (See Figures 11 through 14).

b. Vacuum Compress-Eject

The seal is air evacuated by means of a vacuum pump, then rolled out and ejected to its desired height in the joint with lubricant-adhesive being applied to seal or joint interfaces. (See Figures 15 & 16).

c. Two Phase Pull Down

The seal is held over joint in first phase while an angled tool pulls it down to 3/4 depth. Second phase tool finishes inserting seal to desired depth. Lubricant-adhesive is applied to joint interfaces. (See Figure 17).

d. Combination Vacuum Compress - Two Phase Pull Down

A combination of vacuum compression and two phase pull down incorporated into one device. (See Figure 18).

Lubricant-adhesive is applied to joint interfaces.

e. Progressive Set of Rolling Wheels

This is the simplest in principle, being in effect a series of rolling discs, each taking the seal into the joint progressively deeper. (See Figures 19, 20, 21, 22 & 23).

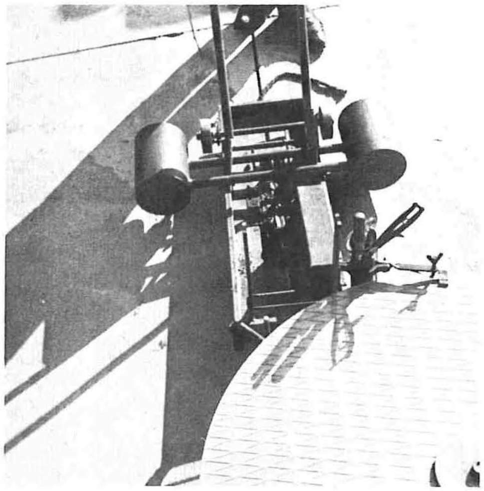


Figure 11. French Compress-Eject machine, fully automatic.

Figure 12. Fully automatic Compress-Eject machine with edge ramp.

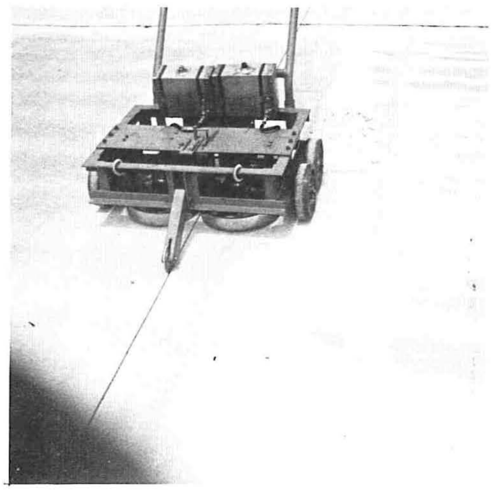


Figure 13. Semi-automatic Compress-Eject machine.

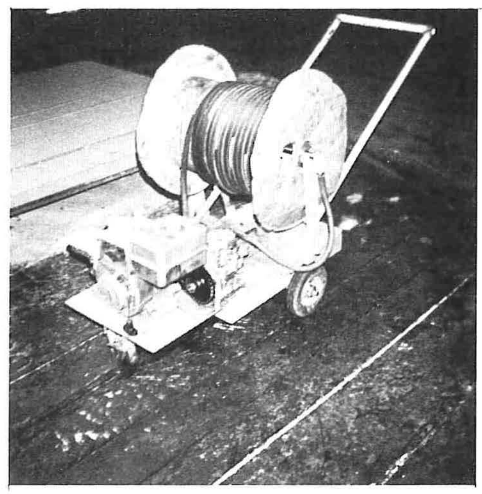


Figure 15. Vacuum Compress-Eject fully automatic machine.

Figure 14. Semi-automatic Compress-Eject machine capable of 10,000 lineal feet per shift.

Figure 16. British Vaccaseal System utilizing vacuum for compression. (Also available in fully automatic)

Figure 17. Two Phase Pull Down fully automatic machine.

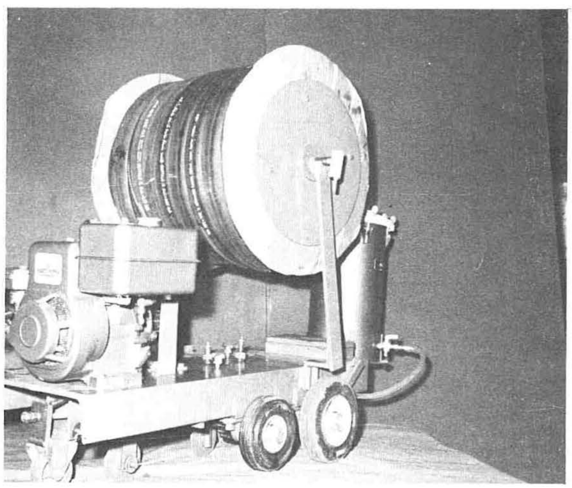


Figure 18.

Combination Vacuum Compress-Eject, Two Phase Pull Down, fully automatic machine.

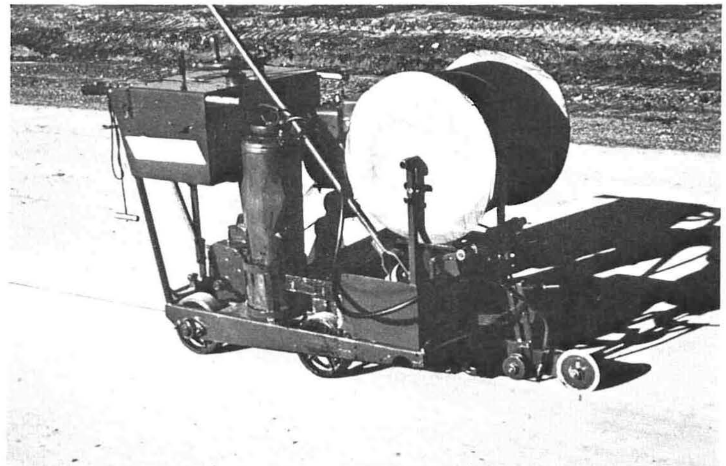


Figure 19.

Progressive Set of Rolling Wheels, fully automatic machine.

Lubricant-adhesive is applied to joint interfaces.

f. Compress-Eject Hand Roller

Seal is compressed between conical rollers and then forced into joint opening with vertical roller wheels. (See Figure 24).

Lubricant-adhesive is applied to joint interfaces.

The development of reliable automatic or semi-automatic machines has been relatively costly and slow, primarily because no two paving projects appear to have the exact same joint geometry, thermal movement, seal configuration, construction personnel, etc. The causes of seal refusal are many and any abrupt change in the joint geometry whether it is due to small spalls, excessive cavitation of interfaces, differential ravelling, etc., will still cause the most sophisticated installing machine to balk. Small stones or debris on the pavement can operate to change the desired setting height.

Insufficient lubricity, changes in viscosity of lubricant-adhesive, humidity and temperature variations, foreign materials on the joint interfaces such as sawing residue, membrane cure in a liquid state, etc., can give machines difficulty.

Since there are a goodly number of excellently qualified firms directing their present efforts toward the development of high type sealing machines, it is opined that there will be available shortly, a number of reliable types of installing machines operating under a variety of principles at a gradually increasing level of sophistication.

ATTENTION TO PROPER JOINTING A NECESSITY

Since a compression seal is in reality a part being inserted into a receptacle, both of which are produced by different firms, attention must be given to achieving not only controlled seal configurations, but joints that are as near the geometry specified as is humanly possible. The problem of saw blade wear has plagued the compression seal industry from its inception. For reasons of efficiency, knowledgeable sawing subcontractors tend to utilize their blades to exact every bit of usage. There is no argument with this except as it operates to prevent the attainment of joint shapes necessary to permit a compression seal to flex without undue stress within its compression limits.

To illustrate this point, a 60 foot long slab in contraction joint pavement is often relieved during the paving operation with a narrow 1/8" sawcut. Subsequently, to obtain a 1/4" or 3/8" or 1/2" joint width, the contractor will run

Figure 20. Progressive Set of Rolling Wheels, fully automatic machine.

Figure 21. Progressive Set of Rolling Wheels, semi automatic machine.

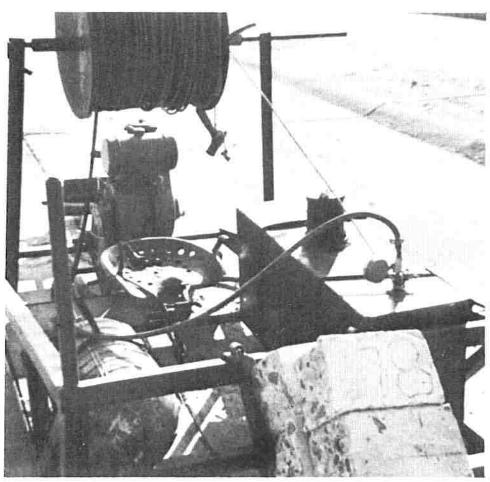


Figure 22. Longitudinal joint sealing machine, fully automatic.

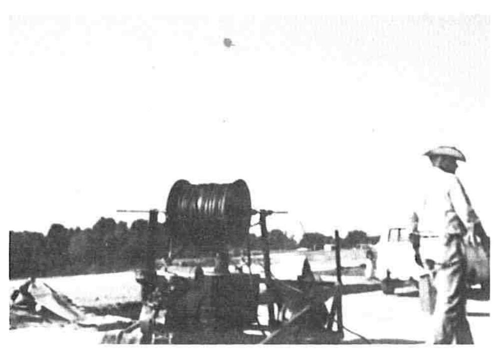


Figure 23. High speed, fully automatic machine. Used in Texas highway pavements, sealing 4 miles of longitudinal joints per day.

a wider chase blade 1/4", 3/8" or 1/2" wide through the joint to bring it out to the specified dimension. In the interim period however, some volume change will occur with the end result that during warm weather, the joint will be able to close back down to a dimension narrower than 1/4", 3/8" or 1/2" as the case may be. This can result in severe over-compression of the seal and has resulted in partial ejection of some seals that were placed close to the riding surface of the pavement with the top portion going into attrition.

The practice of using spansaws, where 3 - 4 saws are used on a single frame spanning the full pavement width, is highly desirable from the standpoint of keeping up with today's high speed paving operations to control random cracks. It may not be possible however, without meticulous inspection and constant adjustments, to produce joints that are not to some degree offset as the saw cuts overlap. (See Figure 25).

As paving trains stretch out their daily mileage, and particularly where short joint spacings are used, sawing contractors have been forced to resort to relief cutting of every third or fourth joint to keep ahead of random cracks. This practice produces for some period of time a runaway pavement insofar as predicting movement at each joint is concerned. Some of these joints in fact never actually crack out or move, so that a permanent condition of unloading of movement results and is reflected in reduced sealing efficiency.

The use of common dowels in pavements is another enemy of healthy or normal slab response, since misalignment and the gradual onset of corrosive seizing of dowels tends to create unloading of movement.

DURABILITY OF JOINT INTERFACES

Since it is not practical to recommend a joint forming or sawing practice that would work well for all pavement designs and environments, attention should be given to producing the most durable interfaces practical for whatever method is utilized.

The sharp edges of contraction joints should be taken off by dragging a form pin across or running a wire brush machine through the joint, the latter of the two being the most effective and consistent. (See Figure 26).

The tendency of a seal to refuse installation can be markedly reduced if this practice is observed and the action of the wire brush against the joint interfaces tends to expose any potential spalls and remove sawing residue, or loose concrete, as well as to produce an interface that is ideal for bonding of the compression seal to the concrete.

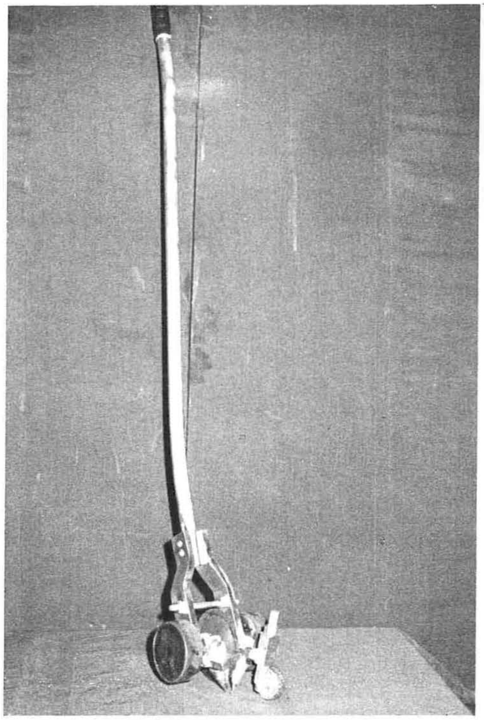


Figure 24. Compress-Eject hand roller.

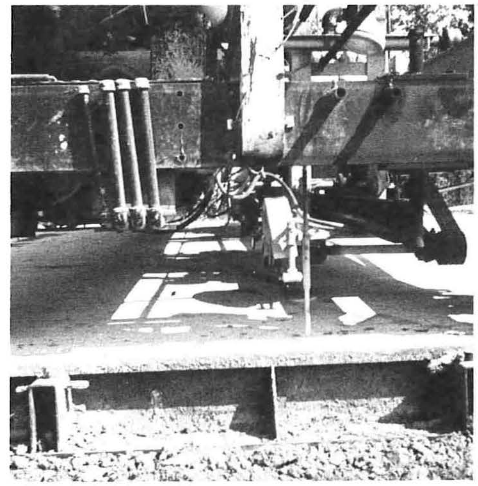


Figure 25. Span saw tends to produce groove overlap unless kept in close adjustment.

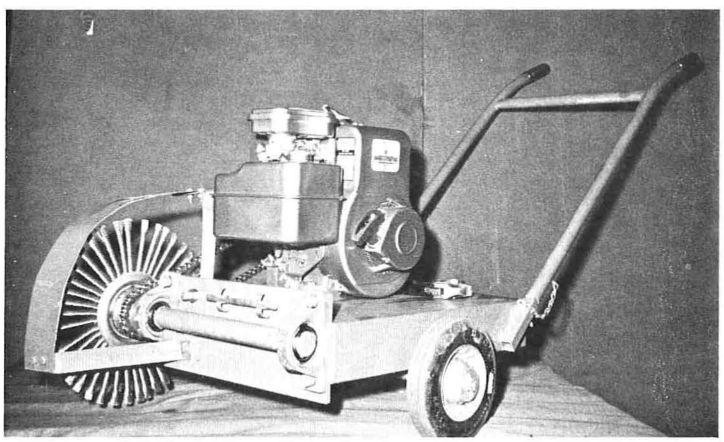


Figure 26.

Wire brush machine conditions joint interfaces. Ideal for compression sealing.

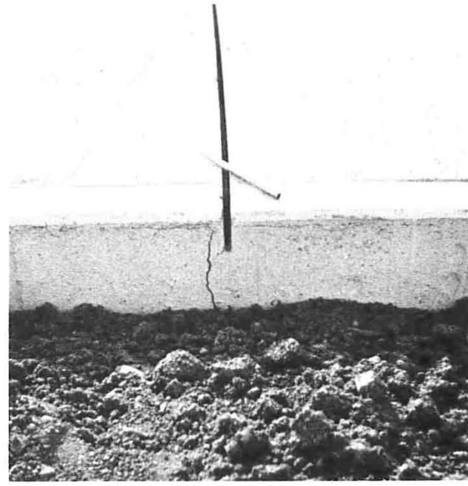


Figure 27.

Forming edge grooves tends to minimize this type of runaway crack.

PAVEMENT EDGE SEALING

As jointed concrete pavements proceed through and respond to the normal conditions of service life, evidence of overstressing from entry of shoulder materials into the sides of pavement slabs at the joints is often apparent. Snow plows and graders can likewise produce corner breaks, the result of which is to rule out the effectiveness of any sealing system at this location of the slab ends and to leave the extreme ends of seals uncompressed with freedom to migrate at will. It is therefore desirable, if practical, to seal the joints at the sides of pavement slabs. Forming edge grooves also tends to minimize the runaway cracks that migrate away from the desired location. (See Figure 27).

As highway departments have begun to utilize compression sealing, the practice of edge sealing has now become fairly widespread in Canada and the United States. (See Figure 28).

Utilizing scab inserts inside of paving forms, grooves are formed which are used as saw indicators and result in one continuous joint across the top, as well as the sides of the pavement slab. One of the more effective scab inserts is the "boomerang", a device made of hard solid formica material which derives its name from its unique shape. (See Figure 29).

Another advantage of edge sealing is that as pavement corners begin to break down in service, the ends of the compression seals are safely held in place by the shoulder materials.

BRIDGE APPROACH JOINTS

Bridge approach joints have as their primary mission the provision for relief of compressive stress between a pavement and a bridge. When used in conjunction with contraction joint pavements, in addition to normal volume changes, they will tend to progressively close. They should therefore be designed in accordance with Figure 3.

If the necessity for greater relief in width is indicated by experience with a particular pavement design, a wider joint may be designed and a larger seal utilized; however, relief steps must be included in the upper portion of the joint to accomodate the sum of seal webs when fully compressed. (See Figure 30).

Because of their greater width and a tendency of bridge approach slabs to settle and become misaligned, it is evident that they are more readily susceptible to spalls from traffic loading. The pitfalls of hand edging of expansion joints also contribute to a loss of edge durability. Figure 31 illustrates one

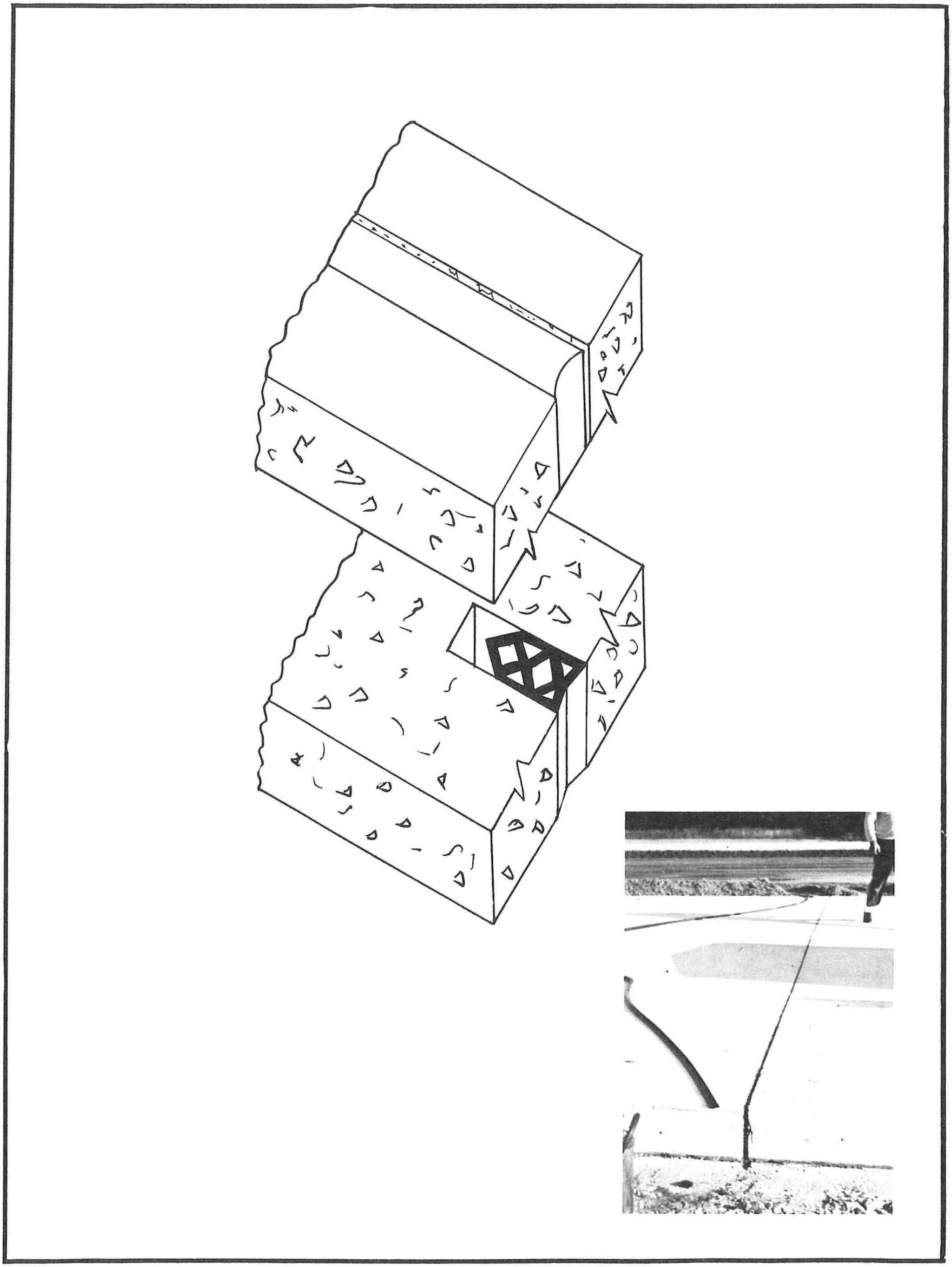


Figure 28. Pavement edge sealing with compression seal.

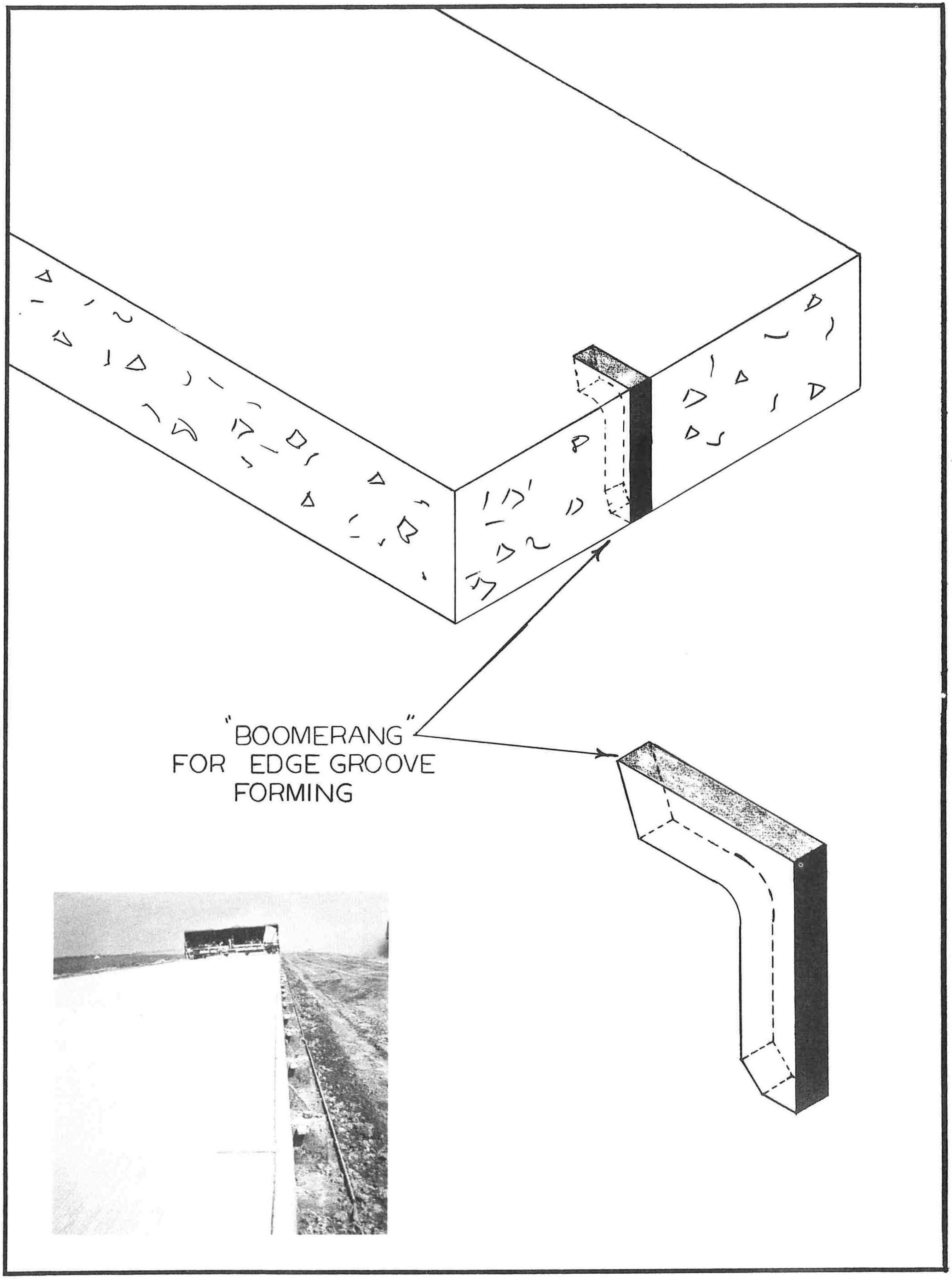


Figure 29. Edge groove formed by a "Boomerang" insert serves as a Saw Point Indicator.

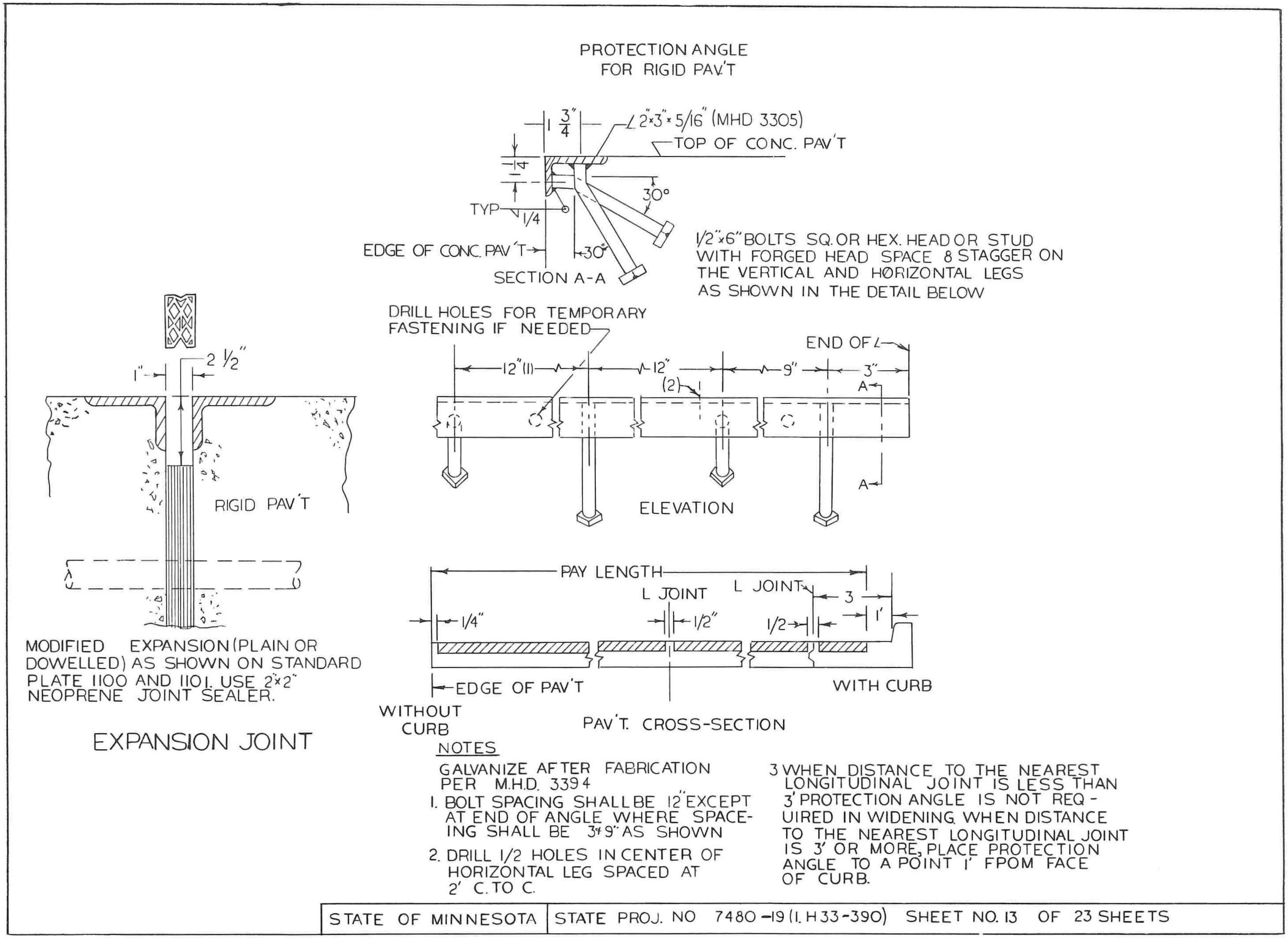


Figure 31. Armor plated bridge approach joint (Minnesota).

state highway department's candidate solution currently being used to add durability and service life in this difficult environment by means of armor plating.

It is apparent that this type of joint could also be utilized in conjunction with continuously reinforced pavements, since the stroke of movement at end joints is usually in the vicinity of 1" and when abutting conventional pavements, there is evidence of the progressive closure phenomenon.

EUROPEAN ADVANCES IN JOINTING & SEALING WITH COMPRESSION SEALS

With hundreds of kilometers of compression seals now in service throughout Europe and South Africa, certain recent modifications have come to light in conventional jointing and sealing practice which give evidence of a potential to extend the maintenance free life of jointed concrete pavements.

Construction of a road or bridge is usually performed by engineer-contractor joint ventures and these firms enjoy fairly unlimited latitude in the selection of a joint sealing medium with one significant difference. The legal responsibility for maintenance of joints in many of the European countries is placed upon the contracting firm for as much as ten years. The materials and methods which offer the longest service quickly become a dollars and sense proposition.

The practice of bevelling the edges of saw-cuts and setting the compression seals near the bottom of the bevel got its start in Switzerland and is now spreading throughout Europe. Figures 32 and 33 illustrate graphically the principle involved, and long term comparisons of performance in the field of both conventional saw cuts as against bevelled edge saw cuts have proven the latter to be markedly superior.

Post construction condition surveys of many millions of feet of both compression seals and field molded sealants have left no question in the writer's mind that this is the direction to go in jointing and sealing practice.

Heavy traffic loadings, the minimal entry of hard materials at the tops of joints, and the right angled shape itself of corners of conventional sawn joints have proven their vulnerability and served to reduce the effectiveness of all sealing systems. The bevelled edge offers a structurally sounder shape for long term repetitive loading and obviates the minor spall condition which causally is related to crushing from entry of hard, high friction foreign matter.

Fully automatic machines have now been developed in Europe that saw the joints, saw the bevelled edges, sandblast the joints, install the lubricant adhesive, and insert the compression seals all in one combined operation.

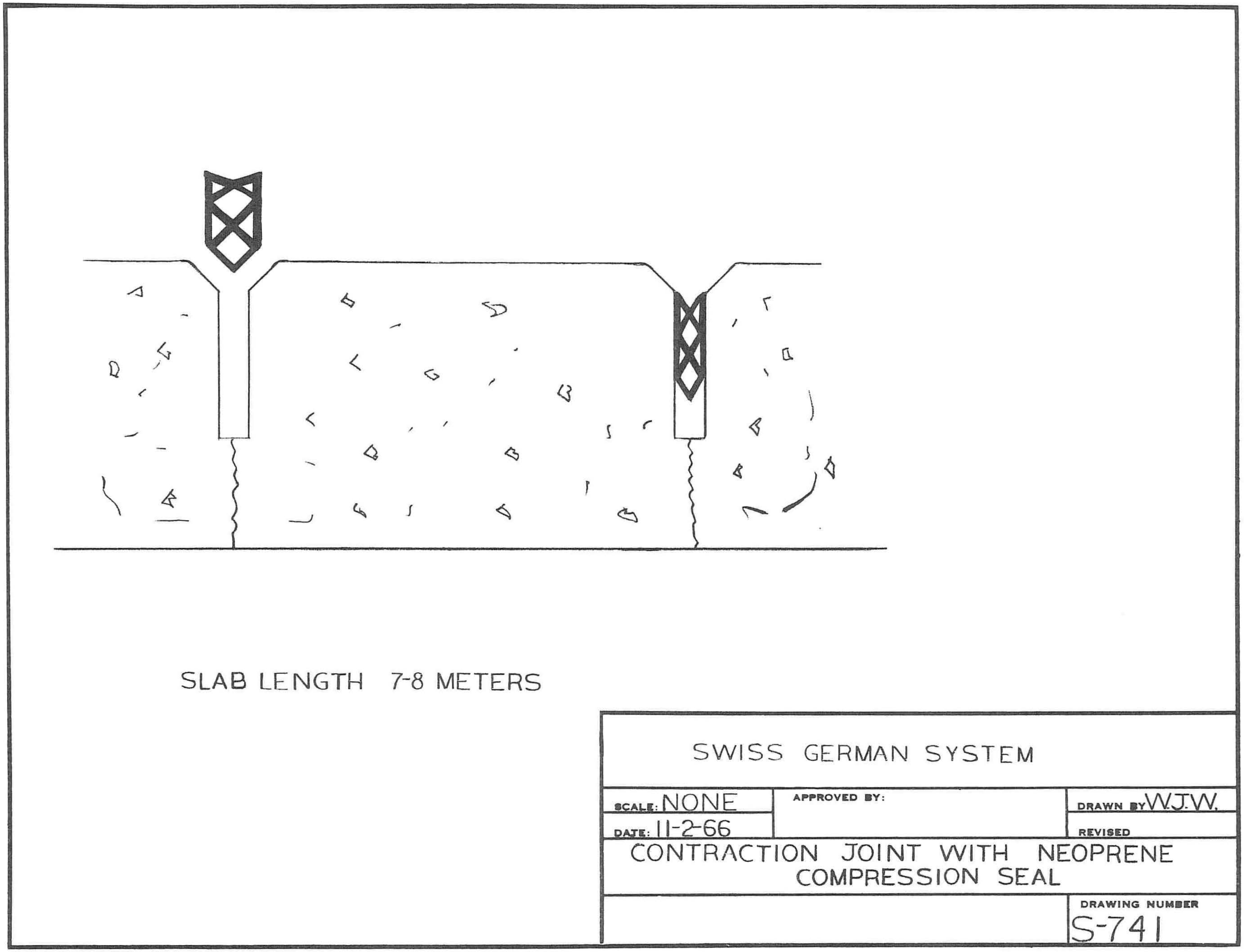


Figure 32. Detail of bevelled saw cuts showing position of compression seal (Swiss-German).

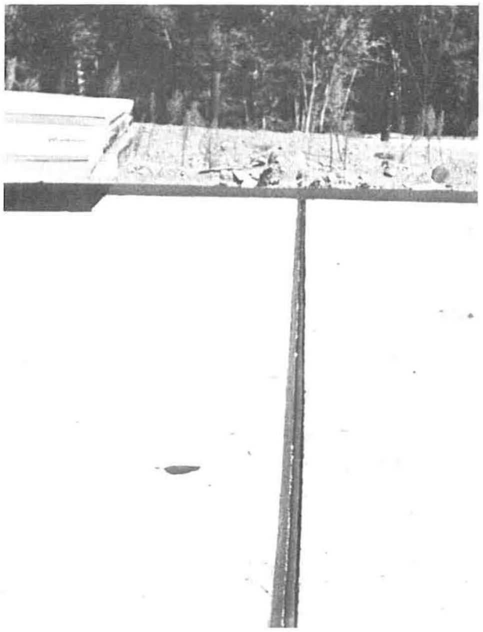


Figure 30. Relief joint with 4" wide compression seal.

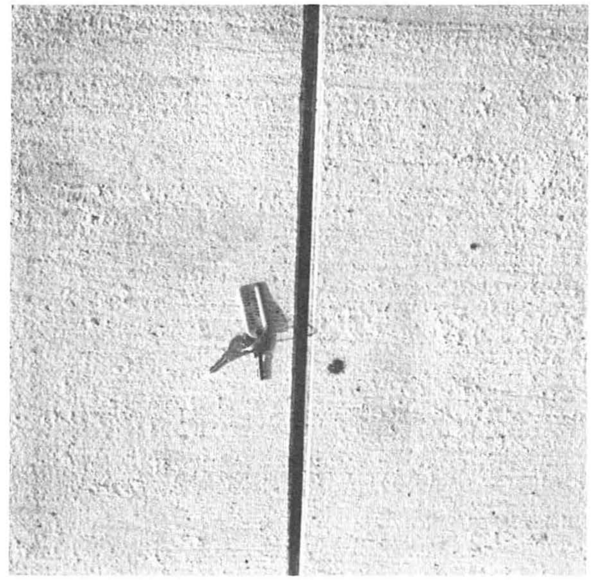


Figure 33. Swiss pavement joint showing bevelled saw cut and compression seal in position.

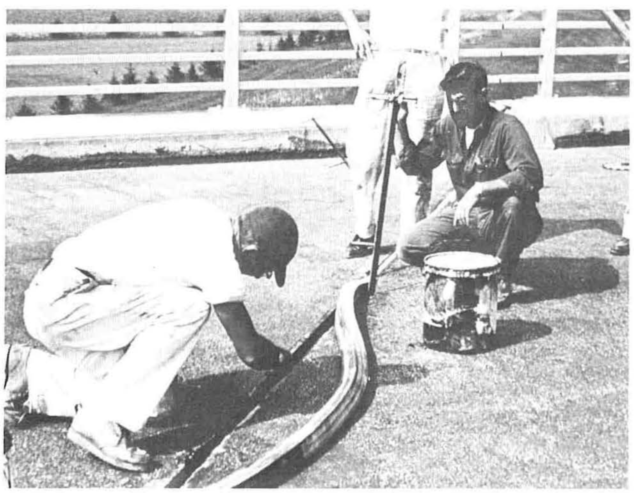


Figure 35. "Pogo Stick" inserter for bridge seals.

Figure 37. 250 lb. roller for inserting bridge seals.

JOINTS IN STRUCTURES

Marked differences in sealing practices are called for in the design of a compression sealing system for bridges. It must have the capability to respond successfully to the many different types of movement that might occur on a specific bridge, whether it be straight distance change between the joint interfaces, racking distortion from the many variations of skews, horizontal, angular, vertical and articulating motion patterns, differential vibrations of slab ends, impact, warping and rotation effects, permanent changes in deck length, creep, plastic flow, etc.

Figure 34 illustrates seal configurations and construction practice recommendations currently in wide usage by state and provincial highway departments throughout North America. Optional curb treatments are included.

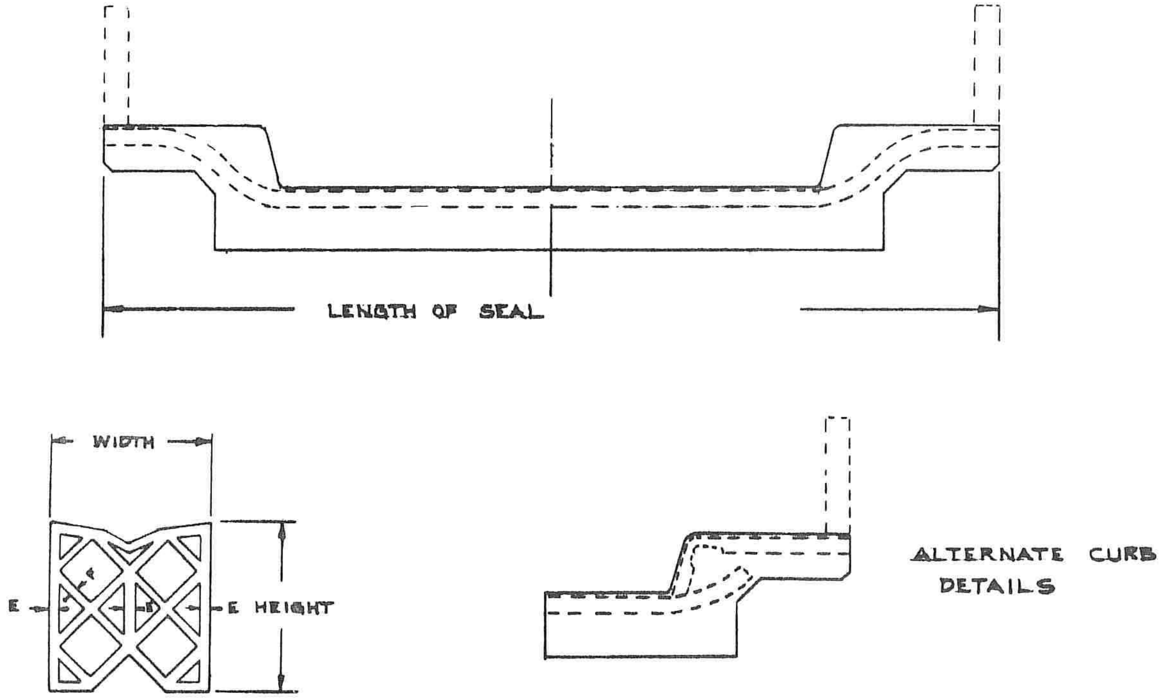
Figure 35 illustrates the use of a "pogo stick" inserter tool that is an effective, low cost inserting tool when used in conjunction with the seal configurations and construction practice recommendations shown in Figure 34.

Figure 36 shows step by step installing procedure.

Figure 37 depicts a heavy steel roller consisting of an inner wheel and two large outer wheels of 2" plate steel. The inner wheel consists of a series of removable 1/16" thick circular steel plates slightly larger in diameter than the outer wheels, roughly from 1/4" to 1/2" depending on the size of seal being installed. The number of inner plates used is also determined from the size of the joint opening. While it does not preclude the use of the "pogo stick" inserter, it aids in producing a faster, smoother and neater installation. For seals without seats, it offers a positive setting height with relation to the riding surface of the pavement.

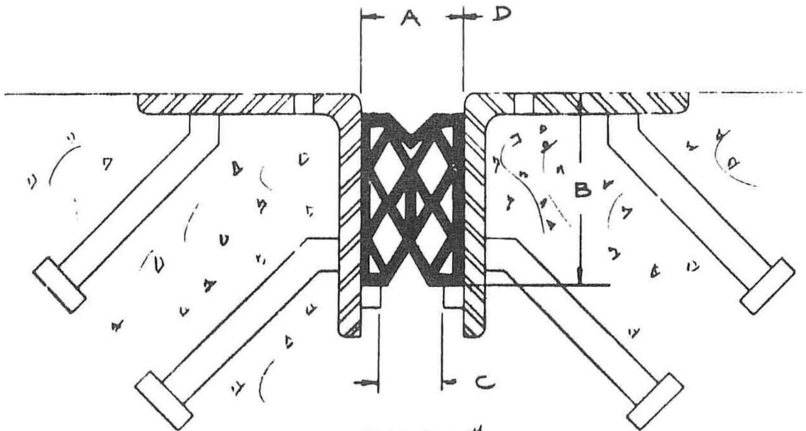
Vise-grip type squeezing tools have also been developed to insert bridge compression seals, and for some types of larger seals, hydraulic compression equipment has been required.

Generally, the installation of bridge compression seals has been accomplished efficiently and effectively with hand tools. Because of their massive fire hose like nature, growth-stretch has not been a matter for concern with these larger, huskier configurations. Tandem blade sawing of the required joint geometry is gaining in popularity on bridge joints. Subsequently, a radius edge is achieved by hand rubbing with an abrasive brick. The resultant interfaces are ideally suited for producing a rubber tearing bond, as well as being structurally sound for long term repetitive loading. Most important, this system now affords the bridge designer a mechanism for achieving precise control of joint width as related to temperature.

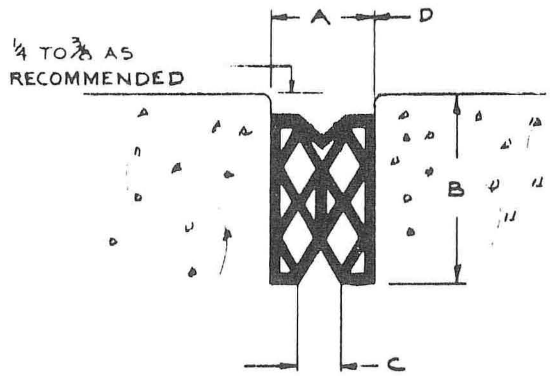


WIDTH	HEIGHT	THICKNESS	
		E	F
1 1/4 +1/8 -.0	1 5/16 ±1/16	.062±.015	.062±.015
1 5/8 +1/8 -0	1 5/8 +1/8 -0	.078±.015	.078±.015
1 3/4 +3/16 -.0	2 ±1/8	1/8 +1/32 -1/64	3/32 +1/32 -1/64
2 +3/16 -0	2 1/16 ±1/8	1/8 +1/32 -1/64	3/32 +1/32 -1/64
2 +1/8 -.0	2 1/16 ±1/8	.078±.015	.078±.015
2 1/4 +3/16 -0	2 5/8 ±1/8	3/16 +3/64 -1/64	3/32 +1/32 -1/64
2 1/2 +1/4 -.0	2 3/4 ±1/8	3/16 +3/64 -1/64	3/32 +1/32 -1/64
3 +1/4 -0	3 13/32 ±3/16	3/16 +3/64 -1/64	1/8 +3/64 -1/64
3 1/2 +1/4 -.0	3 1/2 ±3/16	3/16 +3/64 -1/64	1/8 +3/64 -1/64
4 +5/16 -0	4 23/32 ±1/4	1/4 +3/64 -1/32	3/16 +3/64 -1/64
5 +5/16 -0	5 5/16 ±1/4	1/4 +3/64 -1/32	3/16 +3/64 -1/64
6 +3/8 -0	5 3/4 ±5/16	5/16 +3/64 -1/32	1/4 +3/64 -1/64

Figure 34-1. Seal positioning for joints in bridges and structures.



METHOD #1



METHOD #2

GROOVE SIZE				SEAL SIZE		SLAB LENGTH MAX.							
A	B	C	D	WIDTH	HEIGHT	60	80	90	100	120	140	160	200
1	2 3/8	5/8	3/64	1 3/4	2	■							
1 3/16	2 3/4	3/4	1/16	2	2 1/16		■						
1 3/8	3 1/2	1	5/64	2 1/4	2 5/8			■					
1 1/2	3 1/2	1	5/64	2 1/2	2 3/4				■				
1 3/4	4 1/4	1 1/4	3/32	3	3 13/32					■			
2	4 1/2	1 1/2	7/64	3 1/2	3 1/2						■		
2 3/8	5 3/4	1 1/2	1/8	4	4 23/32							■	
2 3/4	6 1/2	1 1/2	5/32	5	5 5/16								■

NOTE:
A DIM. IS MEASURED AT 70°F
D DIM. IS MINUS FOR EVERY 10°F INCREASE IN TEMP.
D DIM. IS PLUS FOR EVERY 10°F DECREASE IN TEMP.

Figure 34-2. Seal sizing for joints in bridges and structures.

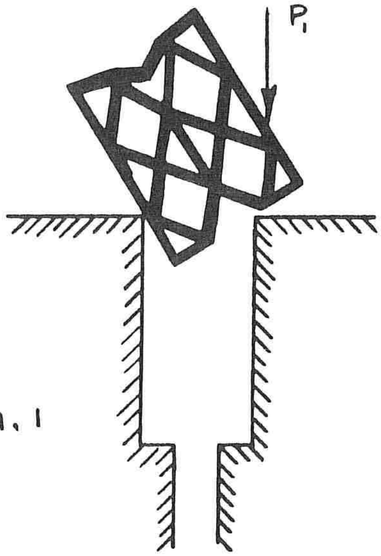


FIG. 1

BRIDGE SEALING INSTRUCTIONS

1. Repair spalled groove area as specified by state.

2. Thoroughly clean groove prior to application of lubricant adhesive.

3. Place seal as shown in Fig. #1 and apply pressure (P1) with installing tool.

4. After seal has been inserted as shown in Fig. #2 apply (P2) and force seal down to seat.

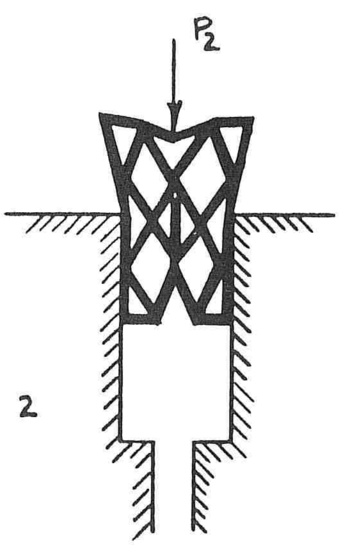


FIG. 2

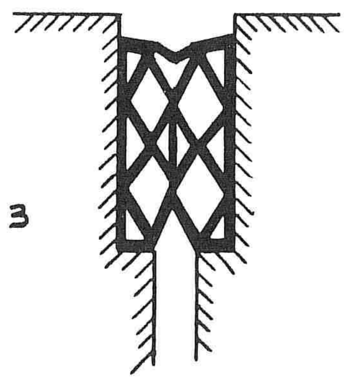


FIG. 3

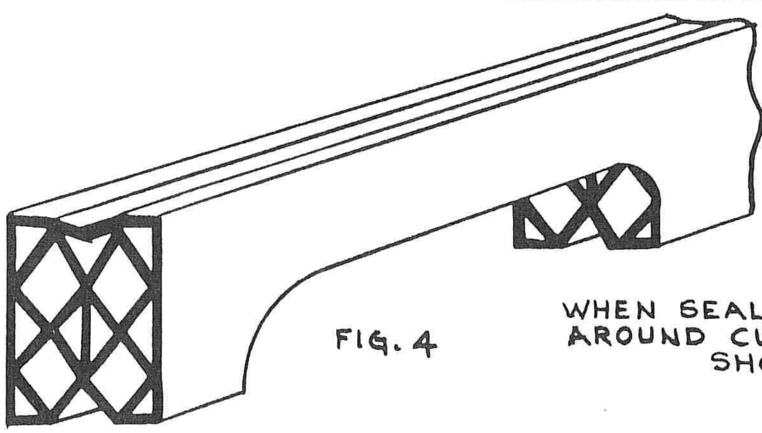


FIG. 4

WHEN SEAL IS TO BE BENT AROUND CURB CUT AS SHOWN

Figure 36. Procedure for bridge seal installation.

SUMMARY

The effectiveness and in-service performance of a compression joint seal is dependent to some degree upon proper installation.

Typical compression seal configurations are in reality, elastomeric sealing devices, each with a rated movement capability, designed to fit into a definite predetermined geometric shape of joint, to accommodate predictable categories and ranges of movements.

Suggested positioning, construction practice, and geometry of joint shapes for contraction, expansion, longitudinal, bridge approach and bridge structure joints, are illustrated and their reasoning defined.

Use of lubricant-adhesives are discussed and the growth-stretch phenomenon described with suggested elongation limits between 5 - 8 per cent, depending upon seal web thicknesses, joint widths and other factors affecting their elongation.

An analysis of current installation machines and practices: automatic, semi-automatic and by hand means is given, and illustrations of typical machines are shown.

A new European approach to seal geometry and seal positioning which is illustrated, gives promise of prolonging the maintenance free life of jointed concrete pavement.